

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Lawrence Examiner #: 71724 Date: 6-16-03
Art Unit: 1745 Phone Number 30 8-4396 Serial Number: 09/942 991
Mail Box and Bldg/Room Location: FE10 Results-Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Core a Free Sheet
Inventors (please provide full names): Order 3 articles

Earliest Priority Filing Date: _____

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

Please Search for a battery having an electrode
I (anode, cathode) comprising a trimer compound comprising
3 units of endole or derivatives in Condensation for
where 2nd position & 3rd position of each unit form
6-membered ring & a portion which can be utilized
as a charge carrier of trimer compound.

II do a structural search where trimer compound is
formula (11). See claim 3

Please send back copy of claims: Thanks,
Lawrence

STAFF USE ONLY

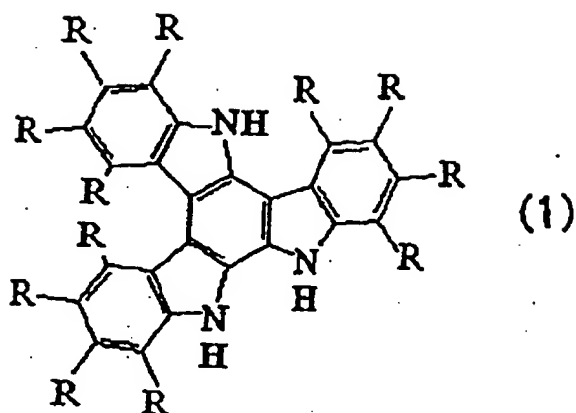
Searcher: EE
Searcher Phone #: _____
Searcher Location: _____
Date Searcher Picked Up: _____
Date Completed: 6-17-03
Searcher Prep & Review Time: 10
Clerical Prep Time: _____
Online Time: 60

Type of Search
NA Sequence (#) _____ STN \$144.44
AA Sequence (#) _____ Dialog _____
Structure (#) (1) Questel/Orbit _____
Bibliographic (2) Dr. Link _____
Litigation _____ Lexis/Nexis _____
Fulltext _____ Sequence Systems _____
Patent Family _____ WWW/Internet _____
Other _____ Other (specify) _____

IN THE CLAIMS

What is claimed is:

1. A secondary battery having an active material of an electrode comprising a trimer compound comprising three units of indole or indole derivatives in condensed ring form, wherein the second position and the third position of each unit form a six-membered ring, and a proton which can be utilized as a charge carrier of the trimer compound.
2. The battery as claimed in Claim 1, wherein the receipt and release of electrons in accordance with the oxidation-reduction reaction of the trimer compound are carried out only by the bonding and elimination of the proton bonded to the trimer compound.
3. The secondary battery as claimed in Claim 1, wherein the trimer compound is represented by the following general formula(1):



wherein each R represents a hydrogen atom or a
5 substituent, independently.

4. The secondary battery as claimed in Claim 1
comprising an electrode containing 30 wt% to 95 wt% of the
trimer compound.

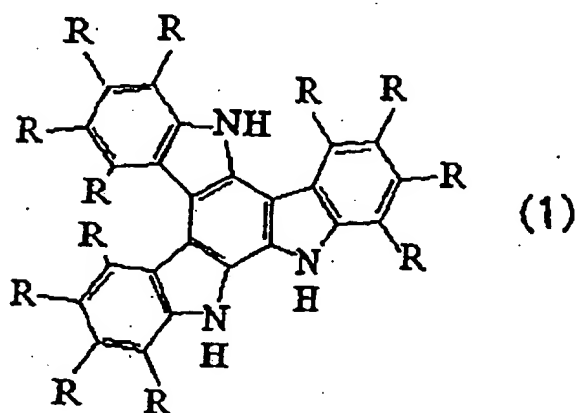
5. The secondary battery as claimed in Claim 1
comprising a solution containing 10^{-3} mol/l to 18 mol/l of
proton as the electrolyte.

6. A capacitor having an active material of an
electrode comprising a trimer compound comprising three
units of indole or indole derivatives in condensed ring
form, wherein the second position and the third position
5 of each unit form a six-membered ring, and a proton which
can be utilized as a charge carrier of the trimer

compound.

7. The capacitor as claimed in Claim 6, wherein the receipt and release of electrons in accordance with the oxidation-reduction reaction of the trimer compound are carried out only by the bonding and elimination of the
5 proton bonded to the trimer compound.

8. The capacitor as claimed in Claim 6, wherein the trimer compound is represented by the following general formula(1):



wherein each R represents a hydrogen atom or a
5 substituent, independently.

9. The capacitor as claimed in Claim 6 comprising an electrode containing 30 wt% to 95 wt% of the trimer

compound.

10. The capacitor as claimed in Claim 6 comprising a solution containing 10^{-3} mol/l to 18 mol/l of proton as the electrolyte.

11. A secondary battery comprising:

a first electrode with a first electrode active material;

5 a second electrode with a second electrode active material; and

an electrolyte intermediate between the first electrode and the second electrode, the electrolyte including a proton source material;

10 wherein the first electrode active material and the second electrode active material undergo a reversible oxidation-reduction reaction, and

both or one of the first and second electrode active materials comprise a trimer compound comprising three units of indole or indole derivatives in condensed ring form, wherein the second position and the third position
15 of each unit form a six-membered ring.

12. A capacitor comprising:

a first electrode with a first electrode active material;

a second electrode with a second electrode active

5 material; and

an electrolyte intermediate between the first electrode and the second electrode, the electrolyte including a proton source material;

wherein the first electrode active material and the
10 second electrode active material undergo a reversible oxidation-reduction reaction, and

both or one of the first and second electrode active materials comprise a trimer compound comprising three units of indole or indole derivatives in condensed ring
15 form, wherein the second position and the third position of each unit form a six-membered ring.

FOI EEO 1.6524660



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Bib Data Sheet

CONFIRMATION NO. 9284

| | | | | |
|--|---|----------------------------------|---|--------------------------------------|
| SERIAL NUMBER 09/942,991 | FILING DATE 08/31/2001 RULE | CLASS 429 | GROUP ART UNIT 1745 | ATTORNEY DOCKET NO. Q66055 |
| APPLICANTS Masato Kurosaki, Tokyo, JAPAN; Toshihiko Nishiyama, Tokyo, JAPAN; Hiroyuki Kamisuki, Tokyo, JAPAN; Gaku Harada, Tokyo, JAPAN; Yuuji Nakagawa, Tokyo, JAPAN; Shinya Yoshida, Tokyo, JAPAN; Tomoki Nobuta, Tokyo, JAPAN; Masaya Mitani, Tokyo, JAPAN; <i>CI 1-5, 11 Secondary battery</i> <i>CI 6-10, 12 A Capacitor</i> | | | | |
| ** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** JAPAN 2000-282309 09/18/2000 | | | | |
| IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 10/02/2001 | | | | |
| Foreign Priority claimed <input type="checkbox"/> yes <input type="checkbox"/> no 35 USC 119 (a-d) conditions met <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Met after Allowance | | STATE OR COUNTRY JAPAN | SHEETS DRAWING 3 | TOTAL CLAIMS 12 |
| Verified and Acknowledged Examiner's Signature _____ Initials _____ | | INDEPENDENT CLAIMS 4 | | |
| ADDRESS SUGHRUE, MION, ZINN, MACPEAK & SEAS 2100 Pennsylvania Avenue, N.W. Washington, DC 20037-3202 | | | | |
| TITLE Secondary battery and capacitor utilizing indole compounds | | | | |
| FILING FEE RECEIVED 790 | FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following: | | <input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit | |

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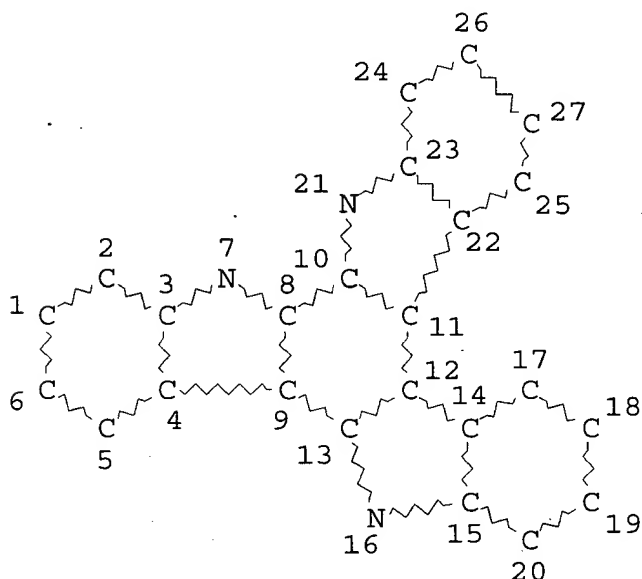
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 L1 STR

FILE 'REGISTRY' ENTERED AT 17:07:29 ON 17 JUN 2003
 L2 6 SEA SSS SAM L1
 L3 125 SEA 10901.4.1/RID

FILE 'HCA' ENTERED AT 17:12:01 ON 17 JUN 2003
 L4 20 SEA L3
 L5 182367 SEA BATTERY OR BATTERIES OR (ELECTROLY? OR ELECTROCHEM?
 OR GALVANI? OR WET OR DRY OR SECONDARY OR PRIMARY) (2A) (CE
 LL OR CELLS) OR WETCELL? OR DRYCELL?
 L6 88716 SEA CAPACIT!R? OR CAPACIT!NC?
 L7 408625 SEA ELECTROLY?
 L8 QUE (52 OR 72)/SC,SX
 L9 10 SEA L4 AND (L5 OR L6 OR L7 OR L8)
 L10 10 SEA L4 NOT L9

=> d l2 que

L1 STR



NODE ATTRIBUTES:

DEFAULT MLEVEL IS ATOM
DEFAULT ECLEVEL IS LIMITED

GRAPH ATTRIBUTES:
RING(S) ARE ISOLATED OR EMBEDDED
NUMBER OF NODES IS 27

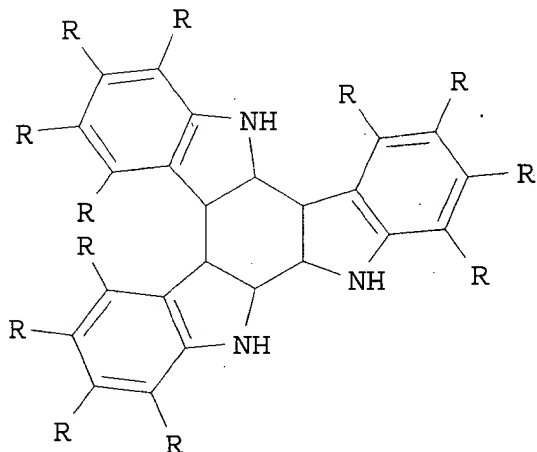
STEREO ATTRIBUTES: NONE
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=> d l9 1 cbib abs hitstr hitind

L9 ANSWER 1 OF 10 HCA COPYRIGHT 2003 ACS
138:388133 **Electrochemical cell** which uses indole
compound. Mitani, Katsuya; Nishiyama, Toshihiko; Kamito, Hiroyuki;
Harada, Manabu; Kurosaki, Masato; Nakagawa, Yuji; Shinoda, Tomoki;
Kaneko, Shinako (NEC Tokin Corp., Japan). Jpn. Kokai Tokkyo Koho JP
2003142099 A2 20030516, 10 pp. (Japanese). CODEN: JKXXAF.
APPLICATION: JP 2001-337837 20011102.

GI



AB The title cell, esp. for **secondary batteries and capacitors**, has an electrode active mass, contg. a mixt. of a trimer I bonded by position 2 and 3, and

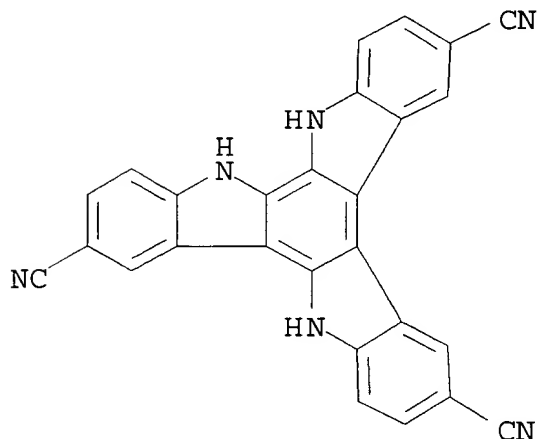
an indole (deriv.) tetramer; and uses a proton as charge carrier.

IT 164671-61-8 403694-95-1

(electrodes contg. indole trimer compds. and tetramers for secondary **batteries** and **capacitors**)

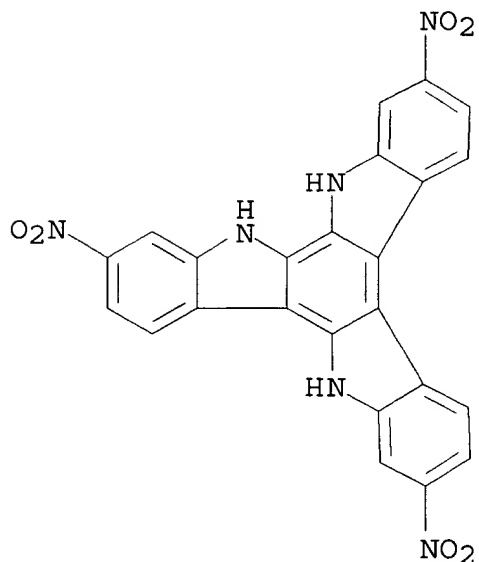
RN 164671-61-8 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarbonitrile,
6,11-dihydro- (9CI) (CA INDEX NAME)



RN 403694-95-1 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-3,8,13-trinitro-
(9CI) (CA INDEX NAME)



IC ICM H01M004-60

ICS H01G009-038; H01G009-058; H01M004-02; H01M010-36

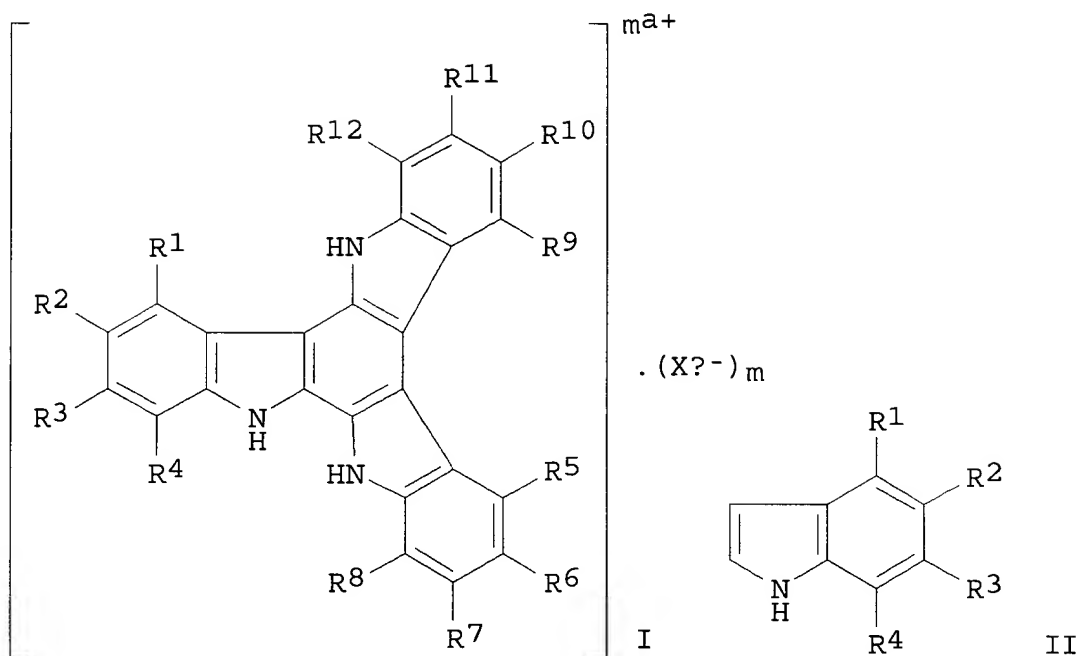
CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)

Section cross-reference(s): 76
ST secondary **battery capacitor** electrode indol
trimer tetramer
IT **Capacitor** electrodes
(electrodes contg. indole trimer compds. and tetramers for
secondary **batteries** and **capacitors**)
IT **Battery** electrodes
(electrodes contg. indole trimers and tetramers for secondary
batteries and **capacitors**)
IT 7664-93-9, Sulfuric acid, uses
(dild., **electrolyte**; electrodes contg. indole trimer
compds. and tetramers for secondary **batteries** and
capacitors)
IT 164671-61-8 220310-61-2 403694-95-1
503269-69-0 527682-27-5 527682-32-2
(electrodes contg. indole trimer compds. and tetramers for
secondary **batteries** and **capacitors**)
IT 76-05-1, uses 108-32-7, Propylene carbonate 429-06-1,
Tetraethylammonium tetrafluoroborate
(**electrolyte**; electrodes contg. indole trimer compds.
and tetramers for secondary **batteries** and
capacitors)

=> d 19 2 cbib abs fhitr hitind

L9 ANSWER 2 OF 10 HCA COPYRIGHT 2003 ACS
136:340667 Method for producing trimer of indole derivative by oxidative
cyclotrimerization of indole derivative, and trimer of indole
derivative and laminated structure thereof. Maeda, Shinichi;
Momose, Fumino; Saitoh, Yoshikazu; Saitoh, Takashi (Mitsubishi Rayon
Co., Ltd., Japan). PCT Int. Appl. WO 2002032903 A1 20020425, 107
pp. DESIGNATED STATES: W: CN, JP, KR, US; RW: AT, BE, CH, CY, DE,
DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR. (Japanese).
CODEN: PIXXD2. APPLICATION: WO 2001-JP8442 20010927. PRIORITY: JP
2000-317045 20001017; JP 2001-159604 20010528.

GI



AB A method for producing a trimer of an indole deriv. [I; R1 - R12 = H, C1-24 linear or branched alkyl or alkoxy, C2-24 linear or branched acyl, CHO, CO₂H or C2-24 linear or branched carboxylic acid ester, SO₃H or C1-24 linear or branched sulfonic acid ester, cyano, OH, NH₂, amido, halo; X_a⁻ = at least one anion selected from Cl⁻, Br⁻, I⁻, F⁻, NO₃⁻, SO₄²⁻, HSO₄⁻, PO₄³⁻, BF₃⁻, ClO₄⁻, SCN⁻, AcO⁻, MeCH₂CO₂⁻, MeSO₃⁻, p-MeC₆H₄SO₃⁻, CF₃CO₂⁻, and CF₃SO₃⁻; a = ion valency of 1-3 integer; m = 0-0.5] comprises oxidizing the indole deriv. (II; R1 - R3 = groups listed in R1 - R12) by the use of an oxidizing agent in a liq. reaction mixt. contg. an org. solvent. The method allows the mass prodn. of the trimer of the indole deriv. with high purity and the novel trimer of the indole deriv. has high electrocond., exhibits high oxidn.-redn. potential and high oxidn.-redn. capacity, and exhibits good redox cycle characteristics. A compn. contg. the trimer I as the main component is useful for antistatics, condenser, **battery**, EMI shield, chem. sensor, display element, org. electroluminescent material, nonlinear material, rust preventive, adhesive, fiber, antistatic coating, plating primer, conductive primer for electrostatic coating, elec. anticorrosion, or electrodeposition (no data). Thus, a soln. of 16.2 g FeCl₃ in 5.4 g H₂O and 40 mL MeCN was added dropwise to a soln. of 1.42 g indole-5-carbonitrile in 10 mL MeCN over 30 min and stirred at 60.degree. for 10 h to give 86% 6,11-5H-diindolo[2,3-a;2',3'-c]carbazole-2,9,14-tricarbonitrile (III) having elemental anal. of (C_{9.00}H_{4.03}N_{1.97}Cl_{0.10})₃, elec. cond. of 0.50 S/cm, and interlayer distance of 0.4 nm according to x-ray crystallog. III and 6,11-dihydro-3,8,13-trinitro-5H-

diindolo[2,3-a;2',3'-c]carbazole showed redox potential of 1.00 and 1.10 V, resp., a total redn. capacity of 330 and 320 C/g, resp., and redox cycle characteristic [redn. capacity after 10,000 redox cycles compared to that of the first cycle (set for 100)] of 85 and 97%, resp.

IT 417708-84-0P

(prepn. of trimers of indole derivs. (5H-diindolo[2,3-a;2',3'-c]carbazole derivs.) with high redox potentials by oxidative cyclotrimerization of indole derivs. in presence of oxidizing agents and laminated structure thereof)

RN 417708-84-0 HCA

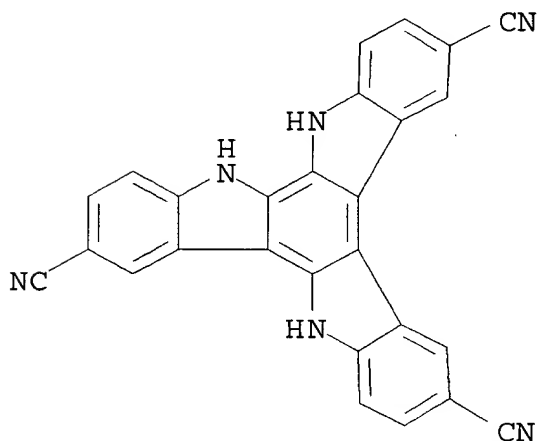
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarbonitrile, 6,11-dihydro-, radical ion(1+), chloride, compd. with 6,11-dihydro-5H-diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarbonitrile (3:7) (9CI) (CA INDEX NAME)

CM 1

CRN 417708-83-9

CMF C27 H12 N6 . Cl

CCI RIS

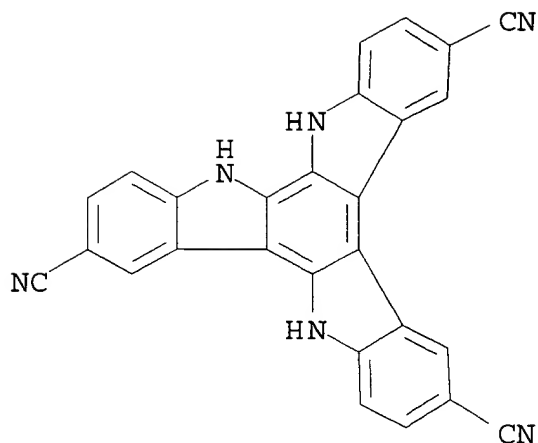


● Cl⁻

CM 2

CRN 164671-61-8

CMF C27 H12 N6



IC ICM C07D487-14
 CC 28-2 (Heterocyclic Compounds (More Than One Hetero Atom))
 Section cross-reference(s): 22, 72, 76
 IT 417708-84-0P 417708-86-2P 417708-88-4P
 417708-90-8P 417708-93-1P 417708-94-2P
 417708-95-3P 418764-77-9P 418764-80-4P
 418764-84-8P 418764-87-1P 418764-90-6P
 418764-93-9DP, reaction product with polyvinylsulfonic acid
 418764-93-9P 418764-96-2P 418764-99-5P
 418765-02-3P 418765-05-6P 418765-08-9P
 418765-11-4P 418765-14-7P 418765-17-0P
 418765-20-5P 418765-23-8P 418765-26-1P
 418765-29-4P 418765-32-9P 418765-35-2P
 418765-38-5P 418765-41-0P 418765-44-3P
 418765-47-6P 418765-50-1P 418765-53-4P
 418765-56-7P 418765-59-0P
 (prepn. of trimers of indole derivs. (5H-diindolo[2,3-a;2',3'-c]carbazole derivs.) with high redox potentials by oxidative cyclotrimerization of indole derivs. in presence of oxidizing agents and laminated structure thereof)

=> d 19 3-10 cbib abs hitstr hitind

L9 ANSWER 3 OF 10 HCA COPYRIGHT 2003 ACS
 136:234747 Secondary **battery** and **capacitor** utilizing indole compounds. Kurosaki, Masato; Nishiyama, Toshihiko; Kamisuki, Hiroyuki; Harada, Gaku; Nakagawa, Yuuji; Yoshida, Shinya; Nobuta, Tomoki; Mitani, Masaya (NEC Corp., Japan). Eur. Pat. Appl. EP 1189295 A2 20020320, 13 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2001-121270 20010905. PRIORITY: JP 2000-282309 20000918.
 AB The present invention provides a secondary **battery** and a **capacitor** which may provide an excellent high rate and cycle

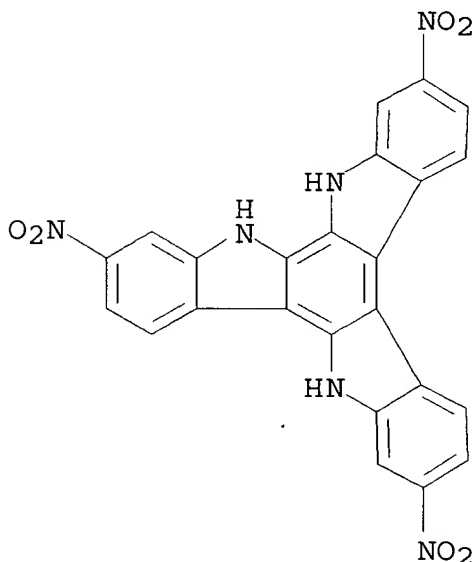
characteristic as well as sufficient emf. and capacity. The secondary **battery** and a **capacitor** have an active material of an electrode comprising a trimer compd. comprising three units of indole or indole derivs. in condensed ring form, wherein the second position and the third position of each unit form a six-membered ring, and a proton which can be utilized as a charge carrier of the trimer compd.

IT 403694-95-1

(secondary **battery** and **capacitor** utilizing indole compds.)

RN 403694-95-1 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-3,8,13-trinitro-(9CI) (CA INDEX NAME)



IC ICM H01M004-02

ICS H01M004-60; H01G009-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 76

ST **battery capacitor** indole compd utilization

IT **Battery** anodes

Battery cathodes

Capacitors

Secondary **batteries**

(secondary **battery** and **capacitor** utilizing indole compds.)

IT Carbon black, uses

Carbon fibers, uses

(secondary **battery** and **capacitor** utilizing indole compds.)

IT 108-32-7, Propylene carbonate 429-06-1, Tetraethylammonium tetrafluoroborate 1493-13-6, Triflic acid 52232-62-9

220310-61-2, 5-Cyanoindole trimer 403694-95-1
(secondary **battery** and **capacitor** utilizing
indole compds.)

IT 120-72-9, Indole, uses
(secondary **battery** and **capacitor** utilizing
indole compds.)

L9 ANSWER 4 OF 10 HCA COPYRIGHT 2003 ACS

132:300021 In situ spectroelectrochemical studies of the fluorescence of
5-substituted indole trimer films. Jennings, Peter; Jones, Anita
C.; Mount, Andrew R. (Department of Chemistry, The University of
Edinburgh, Edinburgh, EH9 3JJ, UK). Physical Chemistry Chemical
Physics, 2(6), 1241-1248 (English) 2000. CODEN: PPCPFQ. ISSN:
1463-9076. Publisher: Royal Society of Chemistry.

AB A novel in situ spectroelectrochem. cell was constructed for the
simultaneous measurement of fluorescence and current-voltage
characteristics during redox cycling. This involves the use of a
detachable rotating disk electrode (RDE), which allows the
characterization of luminescent redox active films produced
electrochem. under controlled hydrodynamic conditions. Using this
cell, the fluorescence of 5-cyanoindole (CI) and indole-5-carboxylic
acid (ICA) films was measured as a function of redox compn. during
cyclic voltammetry at slow sweep rates. At faster sweep rates
hysteresis was obsd. in the recorded fluorescence-charge response,
indicative of a structural change in the film. The rate of this
structural change appears to be decreased by linking the trimer
redox centers in the film and by switching from CI to ICA,
consistent with the influence of intertrimer hydrogen bonding.
Variation in the obsd. fluorescence emission as a function of
wavelength also was obsd., which gives spatial information on the
nature of the film redox reaction. This technique shows potential
as a method for probing the kinetics and mechanisms of the reaction
of electrochemiluminescent films.

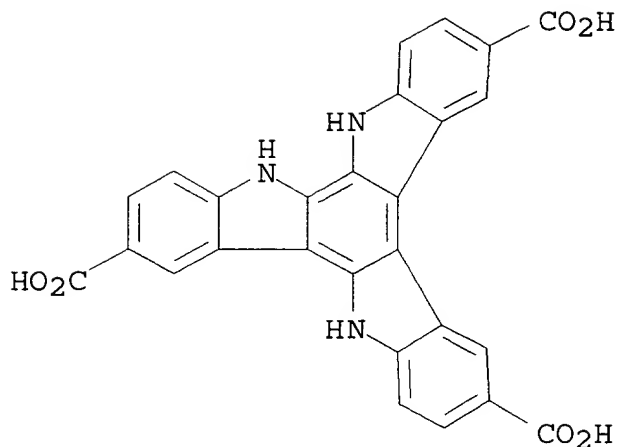
IT 158613-71-9P 164671-61-8P

(in situ spectroelectrochem. studies of fluorescence of
substituted indole trimer films and hydrogen bonding)

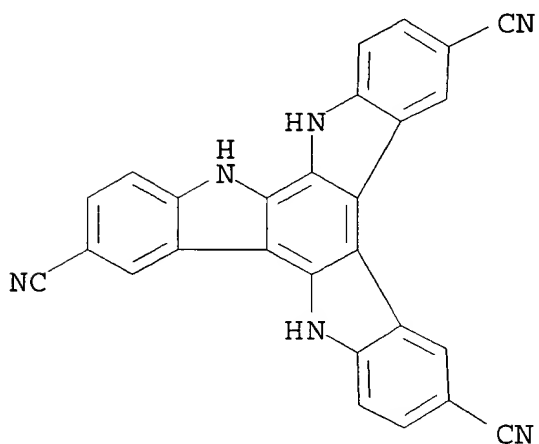
RN 158613-71-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid,
6,11-dihydro- (9CI) (CA INDEX NAME)

not battery



RN 164671-61-8 HCA
 CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid,
 6,11-dihydro- (9CI) (CA INDEX NAME)



CC 72-2 (Electrochemistry)
 Section cross-reference(s): 22, 35, 73, 80
 IT 158613-71-9P 164671-61-8P
 (in situ spectroelectrochem. studies of fluorescence of
 substituted indole trimer films and hydrogen bonding)

L9 ANSWER 5 OF 10 HCA COPYRIGHT 2003 ACS
 132:85068 The redox reaction and induced structural changes of
 5-substituted indole films. Mount, Andrew R.; Robertson, Mark T.
 (Department of Chemistry, The University of Edinburgh, Edinburgh,
 EH9 3JJ, UK). Physical Chemistry Chemical Physics, 1(22), 5169-5177
 (English) 1999. CODEN: PPCPFQ. ISSN: 1463-9076. Publisher: Royal
 Society of Chemistry.

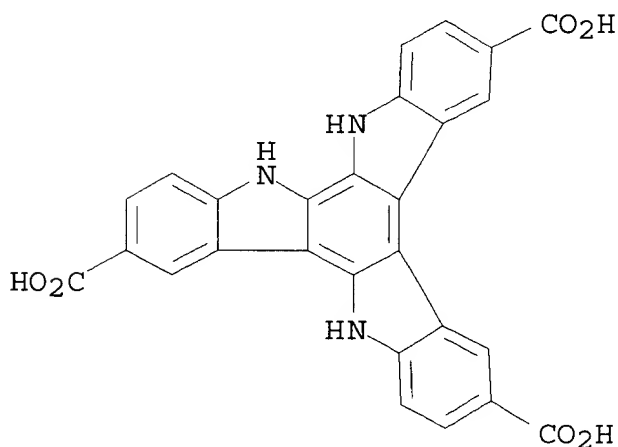
AB The electrochem. behavior of 2 types of electrodeposited redox
 active indole trimer films, 5-cyanoindole (CI) and

indole-5-carboxylic acid (ICA), were studied in acetonitrile **electrolyte** systems. Chronoamperometry, cyclic voltammetry, and transmission line anal. of a.c. impedance data were used to monitor the kinetics and mechanism of the electron transfer process with prolonged redox cycling. As-deposited films of CI and ICA each show high electronic conduction, consistent with the films behaving as a porous metal. CI films show a relatively large, potential dependent barrier to ion insertion, consistent with a compact, poorly solvated structure. In contrast, ICA films display a higher film **capacitance** and a lower barrier to ion insertion, indicating a more open and solvated film. On prolonged slow redox cycling over several days, CI shows little change in coat structure, whereas ICA shows a marked change in its redox reaction, consistent with a change in the mechanism of electron transfer to redox hopping, in the mechanism of ion transfer to cation insertion. This can be explained by the irreversible deprotonation of a carboxylic acid substituent on the trimer center during oxidn., which induces a change in redox mechanism and film structure. Transmission line anal. of small amplitude ac impedance data is shown to be an excellent method for monitoring this and other such changes in modified electrode systems.

IT **158613-71-9 164671-61-8**
(redox reaction and induced structural changes of 5-substituted indole films)

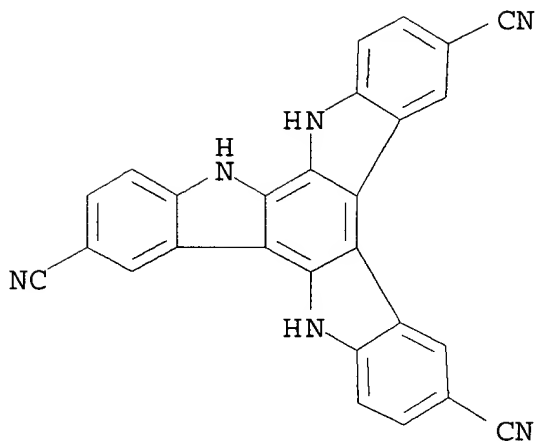
RN 158613-71-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid, 6,11-dihydro- (9CI) (CA INDEX NAME)



RN 164671-61-8 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarbonitrile, 6,11-dihydro- (9CI) (CA INDEX NAME)



CC 72-2 (Electrochemistry)
Section cross-reference(s): 27

IT 158613-71-9 164671-61-8
(redox reaction and induced structural changes of 5-substituted indole films)

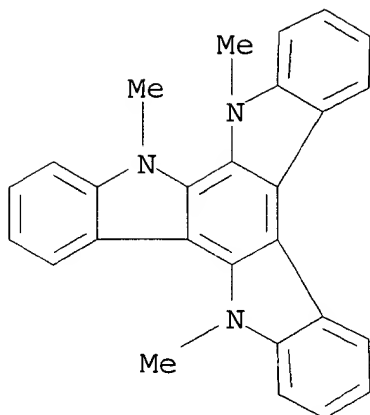
L9 ANSWER 6 OF 10 HCA COPYRIGHT 2003 ACS
128:236305 Electrooxidation of N-methylindole. Mount, Andrew R.; Thomson, Alastair D. (Department of Chemistry, The University of Edinburgh, Edinburgh, EH9 3JJ, UK). Journal of the Chemical Society, Faraday Transactions, 94(4), 553-558 (English) 1998. CODEN: JCFTEV. ISSN: 0956-5000. Publisher: Royal Society of Chemistry.

AB The electrooxidn. of N-methylindole (1-methylindole) gave sol. oligomers. Fluorescence spectroscopy and mass spectrometry indicate that the major product of this reaction is an asym. cyclic trimer, which is also shown to undergo a reversible 1-electron redox reaction. The redox potential for this species is similar to that obtained for 5-methylindole asym. trimer. Also formed are significant fractions of a linear polymer; this is attributed to the steric hindrance of two of the Me groups during the formation of the cyclic trimer, which decrease the propensity for cyclization when compared with 5-substituted and unsubstituted indoles. Further oxidn. of the trimer, in contrast to 5-substituted indoles, does not result in trimer coupling and electroactive film formation. This supports the hypothesis that coupling of 5-substituted indole trimers takes place at the ring nitrogens.

IT 75833-83-9, N-Methylindole asym. cyclic trimer
(electrochem. formation and redox potential and fluorescence and MALDI mass spectra of)

RN 75833-83-9 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-5,6,11-trimethyl-
(9CI) (CA INDEX NAME)

W. Butler

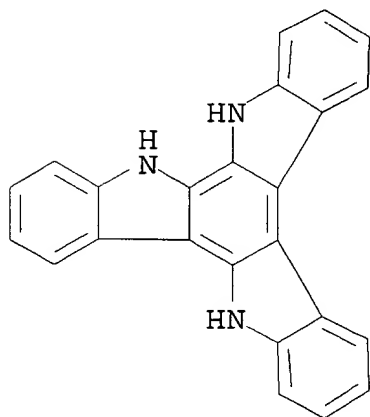


- CC 72-2 (Electrochemistry)
Section cross-reference(s): 22, 37
- IT 75833-83-9, N-Methylindole asym. cyclic trimer
(electrochem. formation and redox potential and fluorescence and MALDI mass spectra of)
- L9 ANSWER 7 OF 10 HCA COPYRIGHT 2003 ACS
128:67666 Electrooxidation of 5-substituted indoles. Jennings, Peter; Jones, Anita C.; Mount, Andrew R.; Thomson, Alastair D. (Dep. Chem., Univ. Edinburgh, Edinburgh, EH9 3JJ, UK). Journal of the Chemical Society, Faraday Transactions, 93(21), 3791-3797 (English) 1997. CODEN: JCFTEV. ISSN: 0956-5000. Publisher: Royal Society of Chemistry.
- AB The electrochem. oxidn. of a wide variety of 5-substituted indole monomers at a Pt electrode gave a redox active film. Electrochem. and spectroscopic evidence is consistent with the redox species in the film being a cyclic trimer. In contrast, the electropolymn. of 5-aminoindole and 5-hydroxyindole on a Pt electrode does not result in redox active film formation. This is attributed to the adsorption of the monomer onto the metal electrode via the substituent, which inhibits this reaction. However, electropolymn. of these monomers onto a predeposited film of 5-cyanoindole or 5-nitroindole gave the cyclic trimer. Electrochem. studies using a rotating-ring disk electrode (RRDE) confirmed the stoichiometry of the trimerization reaction and also that the redox active cyclic trimer species shows reversible one electron redox activity. The half-wave potential for the redn. of each of these trimers shows a linear dependence with the Hammett substituent const., σ^+ or σ^- , as appropriate, detd. for a para-substituted arom. indicating that the 5-substituent is conjugated into the π -electron system of the trimer. Judicious choice of substituents allows control of the trimer redox potential.
- IT 70381-95-2 158613-71-9 164671-61-8
200341-14-6 200341-15-7 200341-16-8
200341-17-9 200341-18-0 200341-19-1
200341-20-4 200341-21-5

(electrooxidn. of 5-substituted indoles and following chem.
reactions on platinum electrode)

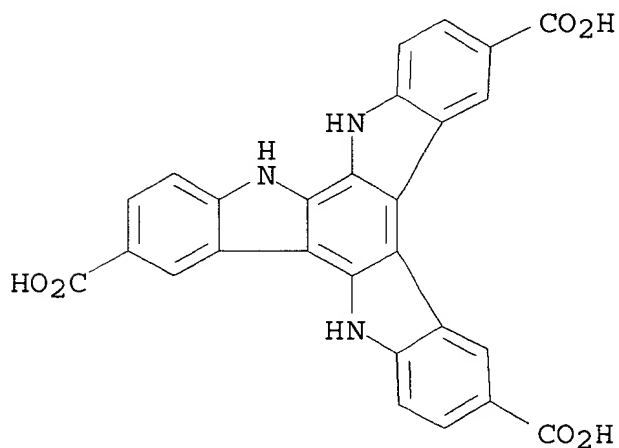
RN 70381-95-2 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro- (9CI) (CA INDEX
NAME)



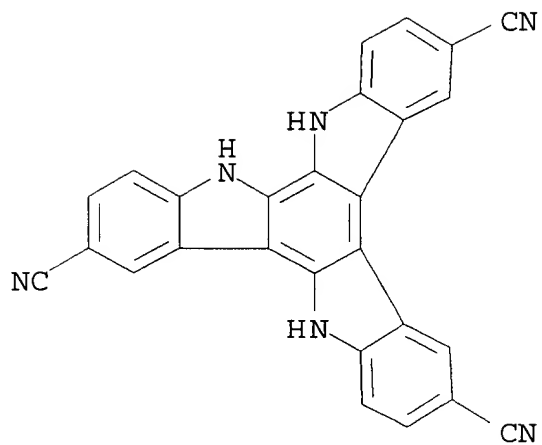
RN 158613-71-9 HCA

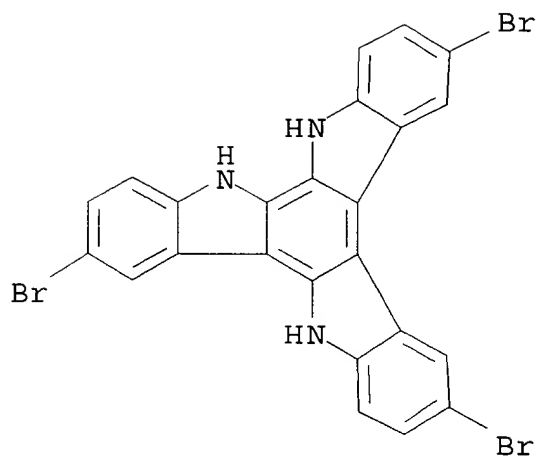
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid,
6,11-dihydro- (9CI) (CA INDEX NAME)



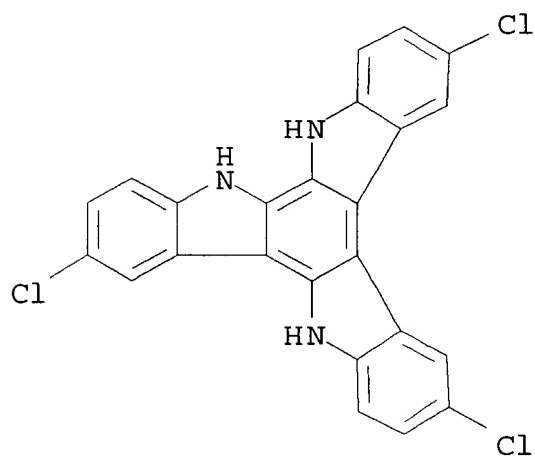
RN 164671-61-8 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarbonitrile,
6,11-dihydro- (9CI) (CA INDEX NAME)

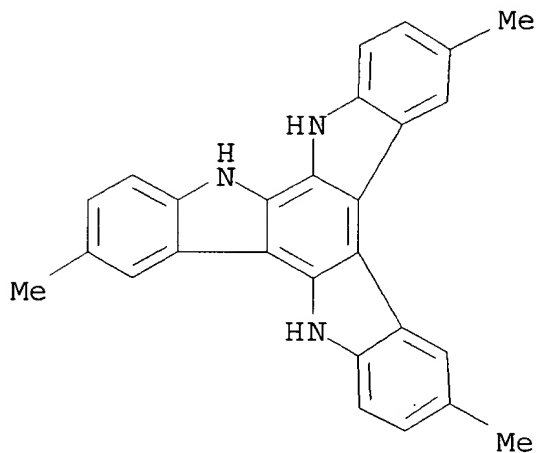




RN 200341-16-8 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 2,9,14-trichloro-6,11-dihydro-
(9CI) (CA INDEX NAME)

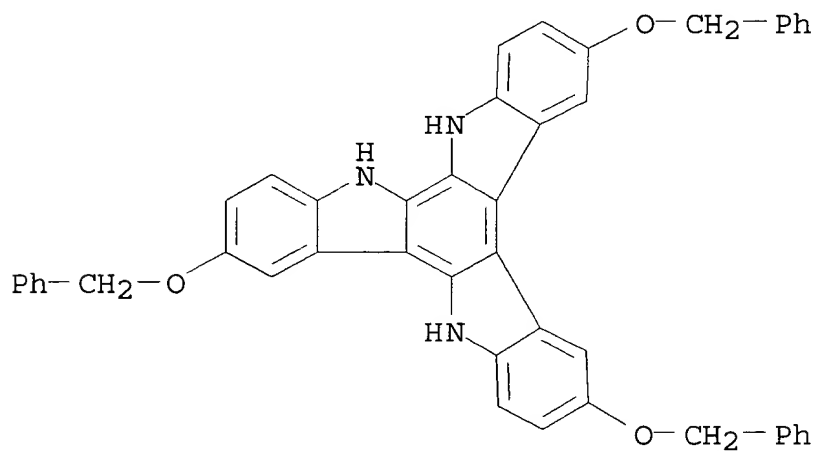


RN 200341-17-9 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-2,9,14-trimethyl-
(9CI) (CA INDEX NAME)



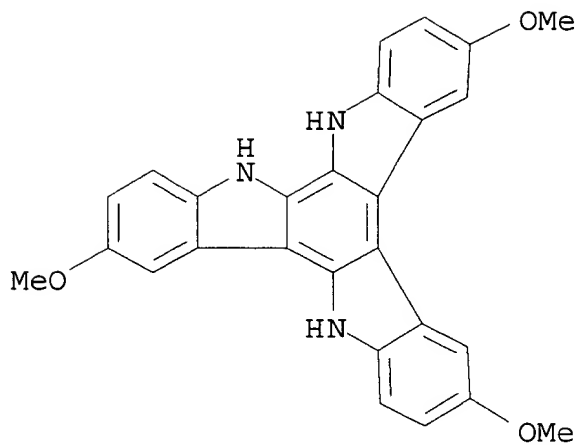
RN 200341-18-0 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-2,9,14-tris(phenylmethoxy)- (9CI) (CA INDEX NAME)

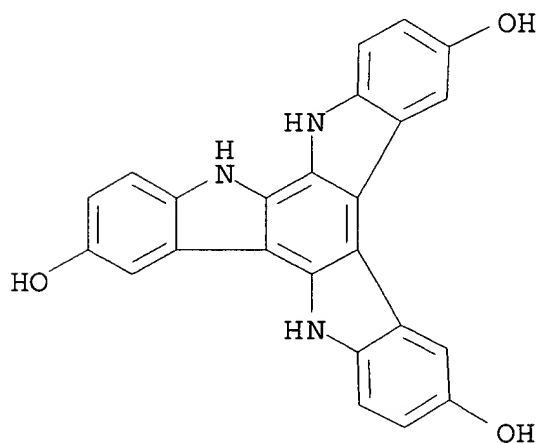


RN 200341-19-1 HCA

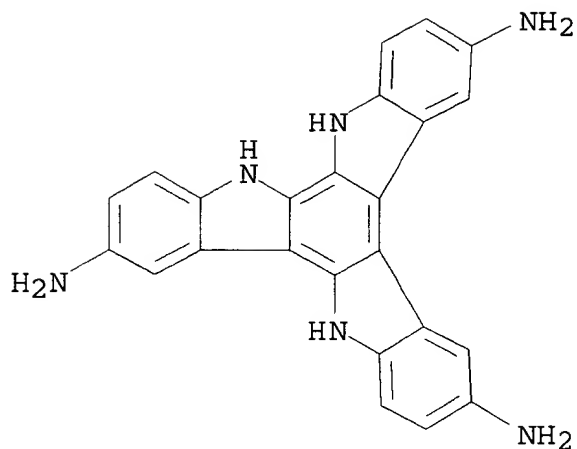
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-2,9,14-trimethoxy- (9CI) (CA INDEX NAME)



RN 200341-20-4 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-triol, 6,11-dihydro-
(9CI) (CA INDEX NAME)



RN 200341-21-5 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-triamine, 6,11-dihydro-
(9CI) (CA INDEX NAME)



CC 72-2 (Electrochemistry)
 Section cross-reference(s): 22, 27, 35
 IT 70381-95-2 82451-55-6, Polyindole 91201-80-8,
 Poly(5-bromoindole) 91201-83-1, Poly(5-carboxyindole)
 91201-84-2, Poly(5-cyanoindole) 158613-71-9
 164671-61-8 183202-08-6, Poly(5-nitroindole)
 200341-14-6 200341-15-7 200341-16-8
 200341-17-9 200341-18-0 200341-19-1
 200341-20-4 200341-21-5
 (electrooxidn. of 5-substituted indoles and following chem.
 reactions on platinum electrode)

L9 ANSWER 8 OF 10 HCA COPYRIGHT 2003 ACS
 125:287245 The synthesis and structural characterization of a charge
 transfer complex of iodine and indole trimer. Bocchi, Vittorio;
 Colombo, Arturo; Porzio, William (Dipartimento di Chimica Organica e
 Industriale, Universita di Parma, Parma, 43100, Italy). Synthetic
 Metals, 80(3), 309-313 (English) 1996. CODEN: SYMEDZ. ISSN:
 0379-6779. Publisher: Elsevier.

AB Indole electrooxidn. using iodine as a supporting
electrolyte yields sheaves of very thin black needles
 identified as a charge transfer complex of iodine and an indole
 trimer. X-ray diffraction studies on this material allows one
 univocally to propose a reliable crystal model in which a disorder
 involving both I3⁻ residues and org. mols. is evidenced. The
 structure consists of stacked mols. of indole trimers (cations) and
 columns of iodines (anions).

IT 183004-21-9P
 (electrosynthesis)

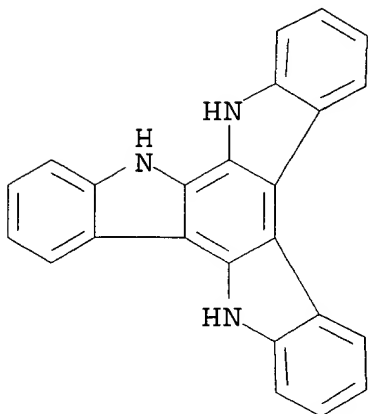
RN 183004-21-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-, compd. with
 iodine (1:1) (9CI) (CA INDEX NAME)

CM 1

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CRN 70381-95-2
CMF C24 H15 N3



CM 2

CRN 7553-56-2
CMF I2

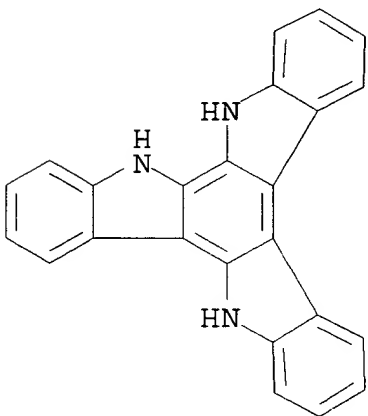
I-I

IT 70381-95-2P

(electrosynthesis of indole trimer by electrooxidn. of indole
with iodine)

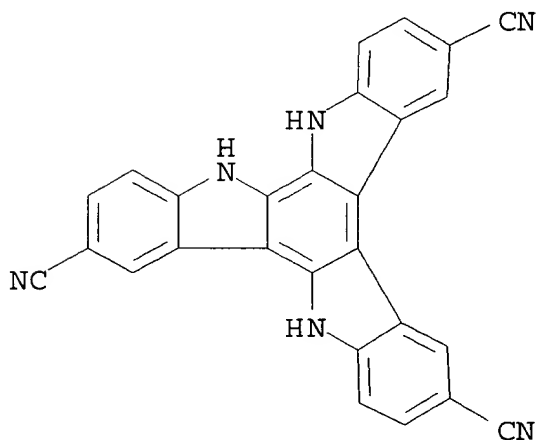
RN 70381-95-2 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro- (9CI) (CA INDEX
NAME)



CC 72-4 (Electrochemistry)
Section cross-reference(s): 75
IT 183004-21-9P

- (electrosynthesis)
IT **70381-95-2P**
(electrosynthesis of indole trimer by electrooxidn. of indole with iodine)
- L9 ANSWER 9 OF 10 HCA COPYRIGHT 2003 ACS
123:68483 The electropolymerization and characterization of 5-cyanoindole. Gordon Mackintosh, J.; Redpath, Craig R.; Jones, Anita C.; Langridge-Smith, Patrick R. R.; Mount, Andrew R. (Department of Chemistry, University of Edinburgh, King's Buildings, West Mains Road, Edinburgh, EH9 3JJ, UK). Journal of Electroanalytical Chemistry, 388(1-2), 179-85 (English) 1995. CODEN: JECHES. ISSN: 0368-1874. Publisher: Elsevier.
- AB The electropolymerization of 5-cyanoindole in acetonitrile leads to the formation and deposition of a cyclic trimer. This trimer then undergoes further oxidation on the electrode surface to form polymeric species. The trimer and polymers can be separated by their differential solubility, and they were structurally characterized. The structure of the trimer is analogous to that found when indole-5-carboxylic acid is polymerized, indicating that the trimer is formed by a similar mechanism. Electrochemical studies indicate that both free trimer and the trimer centers in the polymer are less easily oxidized than indole-5-carboxylic acid; this can be attributed to the increased electronegativity of the 5-cyano substituent which increases the energy of the oxidized form of the redox center.
- IT **164671-61-8P**
(electrochem. prepn. and NMR of)
- RN 164671-61-8 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarbonitrile, 6,11-dihydro- (9CI) (CA INDEX NAME)



- CC **72-2** (Electrochemistry)
Section cross-reference(s): 35, 36
IT **164671-61-8P**
(electrochem. prepn. and NMR of)

L9 ANSWER 10 OF 10 HCA COPYRIGHT 2003 ACS

121:240539 Determination of the structure of electropolymerized indole-5-carboxylic acid. Mackintosh, J. Gordon; Redpath, Craig R.; Jones, Anita C.; Langridge-Smith, Patrick R. R.; Reed, David; Mount, Andrew R. (Department of Chemistry, University of Edinburgh, King's Buildings, West Mains Road, Edinburgh, EH9 3JJ, UK). Journal of Electroanalytical Chemistry, 375(1-2), 163-8 (English) 1994. CODEN: JECHES. ISSN: 0368-1874.

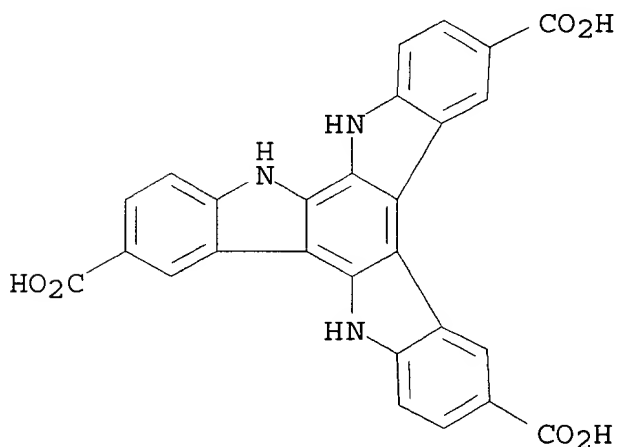
AB The electropolymn. of indole-5-carboxylic acid leads to the deposition of a film on the electrode surface. Two different chem. species are deposited, and these can be sepd. by their differential soly. in DMF. These products have each been characterized by mass spectroscopy, UV-visible and fluorescence spectroscopy, IR spectroscopy and NMR spectroscopy. It is clear from these data that the DMF-sol. species is an electrodeposited trimer, whereas the species which is much less sol. in DMF or THF, but is sol. in DMSO, appears to be a polymeric species made up of linked trimer units.

IT 158613-71-9

(electrochem. formation and structure of electrodeposited films of)

RN 158613-71-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid, 6,11-dihydro- (9CI) (CA INDEX NAME)



CC 72-2 (Electrochemistry)

Section cross-reference(s): 36

IT 91201-83-1 158613-71-9

(electrochem. formation and structure of electrodeposited films of)

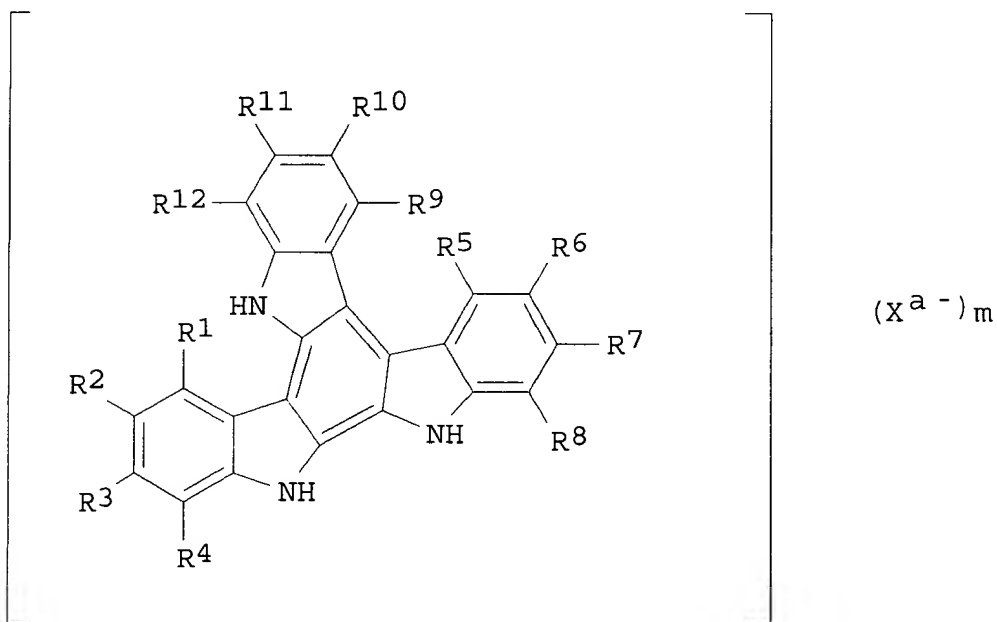
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L10 ANSWER 1 OF 10 HCA COPYRIGHT 2003 ACS

138:347327 Electrically conductive compositions, conductors with transparent conductive films of the compositions, and their

formation. Saito, Takashi; Maeda, Shinichi; Saito, Yoshikazu (Mitsubishi Rayon Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2003123532 A2 20030425, 20 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-316936 20011015.

GI



I

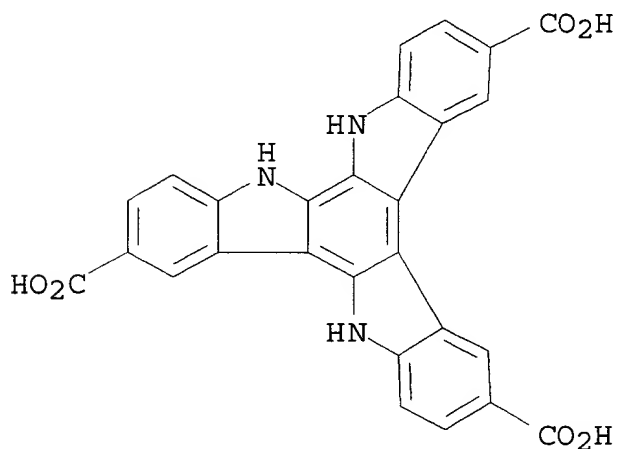
AB The compns. contain (A) indole derivs. trimers, (B) solvents, (C) crosslinking agents which may be (D) silane coupling agents represented by general formula YXSiR₄₈R₄₉R₅₀ [R₄₈- R₅₀ = H, C1-6 alkyl, C1-6 alkoxy, amino, acetyl, Ph, halo; X = (CH₂)_n, (CH₂)_nO(CH₂)_l; n, l = 1-6; Y = OH, SH, amino, epoxy, epoxycyclohexyl], and optionally (C) colloidal SiO₂, (F) bases, (G) macromols., (H) surfactants, and (I) inorg. salts. Preferably, the indole derivs. trimers comprise I [R₁-R₁₂ = H, C1-24 alkyl, C2-24 alkoxy, C2-24 acyl, aldehyde, CO₂H, C1-24 sulfonate, cyano, OH, NO₂, amino, amide, halo; X^{a-} = .gtoreq.1 of 1-3-valent anion of Cl, Br, I, F, H₂SO₄, hydrogensulfate, H₃PO₄, B fluoride, perchloric acid, thiocyanic acid, AcOH, propionic acid, methanesulfonic acid, p-toluenesulfonic acid, trifluoroacetic acid, and trifluoromethanesulfonic acid ion; a = 1-3 integer; m (dopant ratio) = 0-0.5]. Preferably, the indole derivs. trimers are prepd. by reacting indole derivs. with oxidizing agents in solvents. The elec. conductors are obtained by applying the elec. conductive compns. on .gtoreq.1 side of a substrate to provide transparent elec. conductive layer(s), (doping with acids,) and leaving at ambient temp. or subjecting to thermal treatment. The compns. have high elec. cond. free from moisture dependency, good film forming property, moldability, transparency, resistancees to solvents and

water, high hardness, and weather resistance.

IT 158613-71-9P 164671-61-8P 514225-85-5P
(elec. conductive compns. contg. indole derivs. trimers for
transparent conductive films)

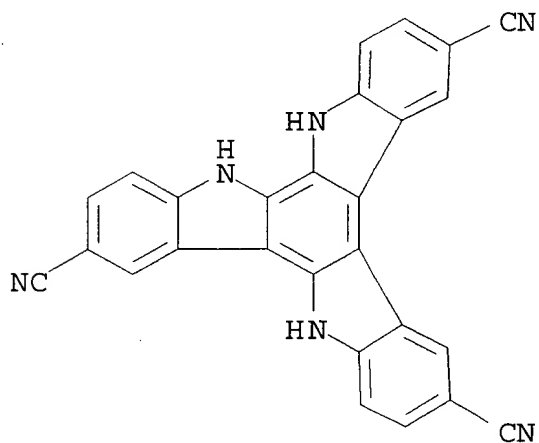
RN 158613-71-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid,
6,11-dihydro- (9CI) (CA INDEX NAME)



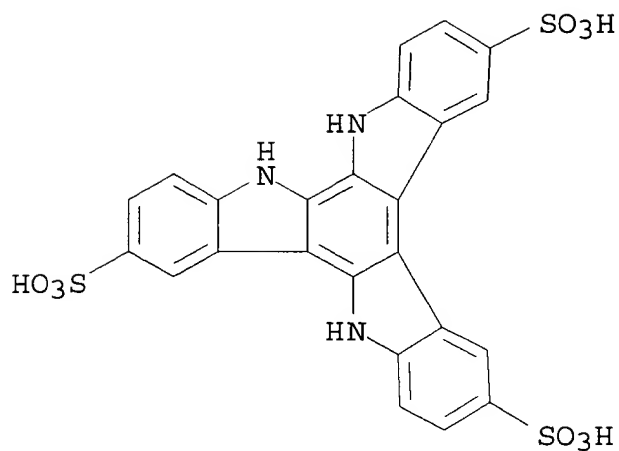
RN 164671-61-8 HCA

5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarbonitrile,
6,11-dihydro- (9CI) (CA INDEX NAME)



RN 514225-85-5 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-trisulfonic acid,
6,11-dihydro- (9CI) (CA INDEX NAME)



IT 158613-71-9P 164671-61-8P 514225-85-5P

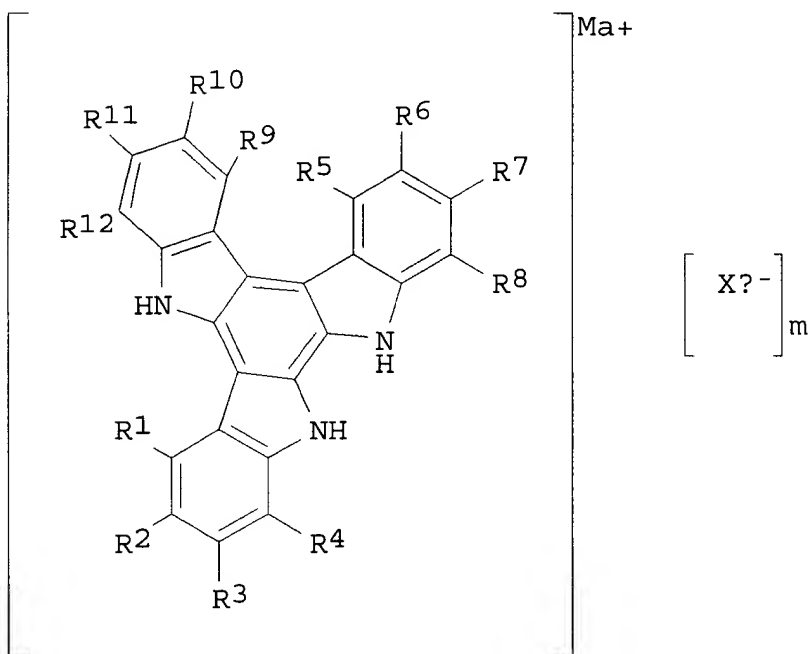
(elec. conductive compns. contg. indole derivs. trimers for transparent conductive films)

L10 ANSWER 2 OF 10 HCA COPYRIGHT 2003 ACS

138:291219 Corrosion inhibitor comprising indole derivative trimer.

Maeda, Shinichi; Saito, Yoshikazu; Saito, Takashi (Mitsubishi Rayon Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2003096578 A2 20030403, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-287186 20010920.

GI



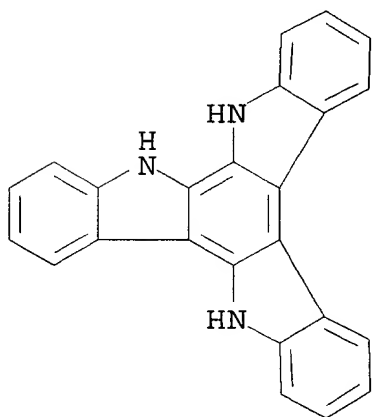
AB A corrosion inhibitor comprises an indole deriv. trimer, or an indole deriv. trimer and a solvent, a polymer, and a surfactant. The indole deriv. trimer is preferably I (where R1-R12 are H, C1-24 alkyl, C1-24 alkoxy, C2-24 acyl, aldehyde, carboxylic acid group, C2-24 carboxylate, sulfonic acid group, C1-24 sulfonate, cyano, OH, nitro, amino, amido, and/or halogen; Xa- is an ion of Cl, Br, I, F, nitric acid, sulfuric acid, phosphoric acid, borofluoride, perchloric acid, thiocyanic acid, acetic acid, propionic acid, methanesulfonic acid, p-toluenesulfonic acid, trifluoroacetic acid, trifluoromethanesulfonic acid, polystyrenesulfonic acid, polyvinylsulfonic acid, poly(2-acrylamino-2-methylpropane)sulfonic acid, and/or polyvinylsulfuric acid; m is 0-0.5). The inhibitor is coated on an article to form a protective film.

IT **70381-95-2P 158613-71-9P 164671-61-8P**
418764-79-1P

(corrosion inhibitor comprising indole deriv. trimer)

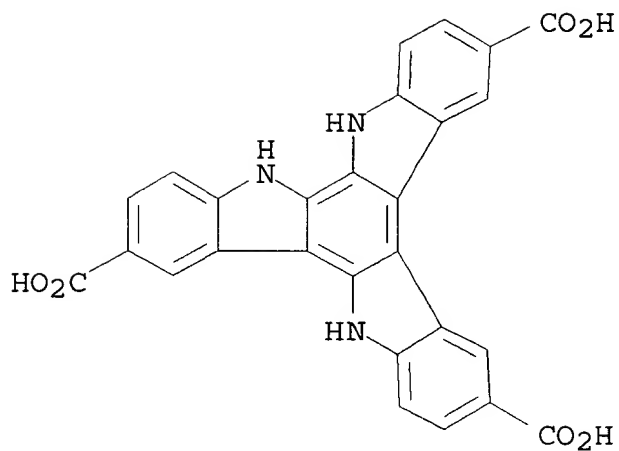
RN 70381-95-2 HCA

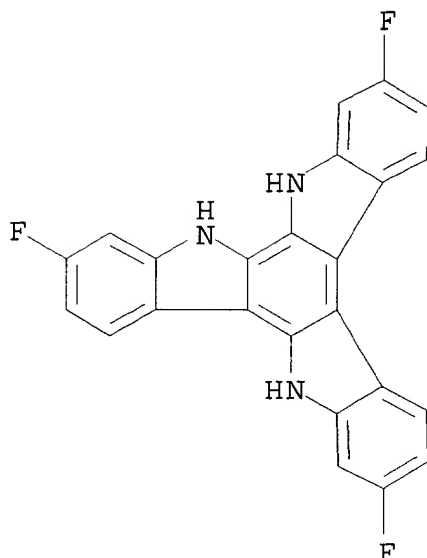
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro- (9CI) (CA INDEX NAME)



RN 158613-71-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid, 6,11-dihydro- (9CI) (CA INDEX NAME)





IT 70381-95-2P 158613-71-9P 164671-61-8P
418764-79-1P

(corrosion inhibitor comprising indole deriv. trimer)

L10 ANSWER 3 OF 10 HCA COPYRIGHT 2003 ACS

134:178232 Oxidative trimerization of indole: on the formation of dications and radical cations by reaction of indole and nitrosobenzene in the presence of acids. Greci, Lucedio; Tommasi, Giampaolo; Petrucci, Rita; Marrosu, Giancarlo; Trazza, Antonio; Sgarabotto, Paolo; Righi, Lara; Alberti, Angelo (Dipartimento di Scienze dei Materiali e della Terra, Universita Ancona, Ancona, I-60131, Italy). Perkin 2 (11), 2337-2342 (English) 2000. CODEN: PRKTFO. ISSN: 1470-1820. OTHER SOURCES: CASREACT 134:178232. Publisher: Royal Society of Chemistry.

AB The reactions of indole with nitrosobenzene in the presence of acetic, monochloroacetic, monobromoacetic and trichloroacetic acid afford as the main product a deep-green ppt., which in a preceding study had been erroneously identified as the aminyl radical of a trimer indole. The identity of the minor products was confirmed. This paper deals with the detn. of the correct structure of the compds. contained in the ppt. through a study based on chem. reactions, electrochem. measurements and X-ray anal.

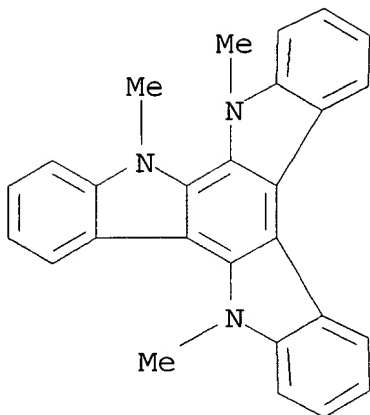
IT 75833-83-9P

(crystallog.; formation of dications and radical cations by reaction of indole and nitrosobenzene in presence of acids)

RN 75833-83-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-5,6,11-trimethyl-(9CI) (CA INDEX NAME)

nt better



IT 326492-87-9

(formation of dications and radical cations by reaction of indole and nitrosobenzene in presence of acids)

RN 326492-87-9 HCA

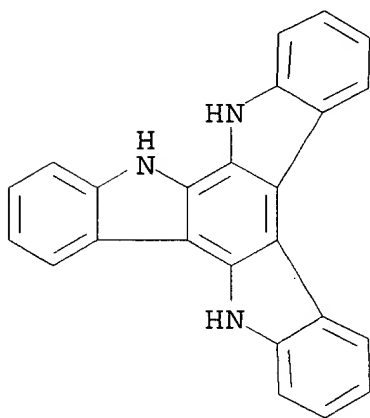
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-, radical ion(1+), sulfate (1:1) (9CI) (CA INDEX NAME)

CM 1

CRN 182440-60-4

CMF C24 H15 N3

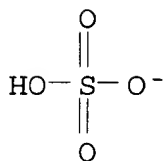
CCI RIS



CM 2

CRN 14996-02-2

CMF H O4 S



IT 326492-89-1 326492-90-4 326492-91-5
 (formation of dications and radical cations by reaction of indole
 and nitrosobenzene in presence of acids)

RN 326492-89-1 HCA

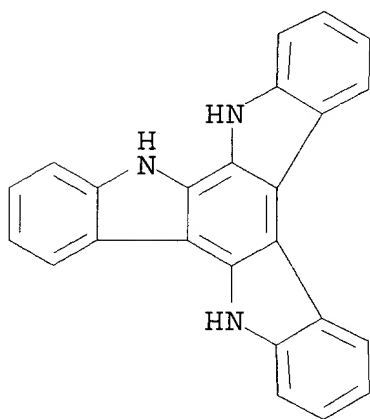
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-, radical ion(1+),
 acetate (9CI) (CA INDEX NAME)

CM 1

CRN 182440-60-4

CMF C24 H15 N3

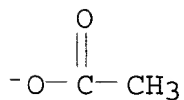
CCI RIS



CM 2

CRN 71-50-1

CMF C2 H3 O2

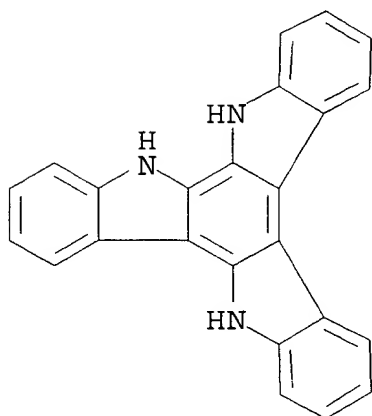


RN 326492-90-4 HCA

CN Acetic acid, trichloro-, ion(1-), salt with 6,11-dihydro-5H-
 diindolo[2,3-a:2',3'-c]carbazole (1:1) (9CI) (CA INDEX NAME)

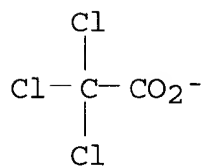
CM 1

CRN 182440-60-4
CMF C24 H15 N3
CCI RIS



CM 2

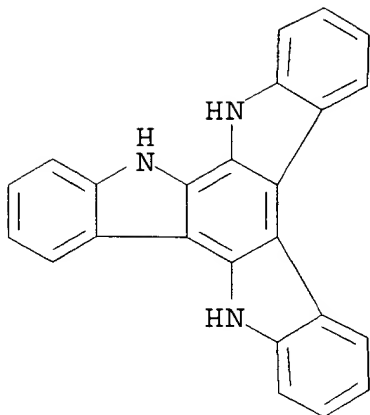
CRN 14357-05-2
CMF C2 Cl3 O2



RN 326492-91-5 HCA
CN Acetic acid, bromo-, ion(1-), salt with 6,11-dihydro-5H-diindolo[2,3-a:2',3'-c]carbazole (1:1) (9CI) (CA INDEX NAME)

CM 1

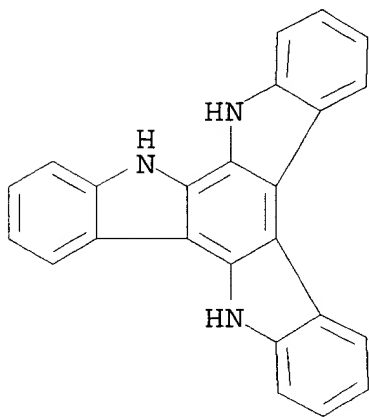
CRN 182440-60-4
CMF C24 H15 N3
CCI RIS



RN 326492-82-4 HCA
CN Acetic acid, chloro-, ion(1-), salt with 6,11-dihydro-5H-diindolo[2,3-a:2',3'-c]carbazole (1:1) (9CI) (CA INDEX NAME)

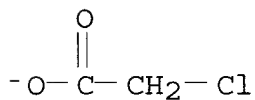
CM 1

CRN 182440-60-4
CMF C24 H15 N3
CCI RIS

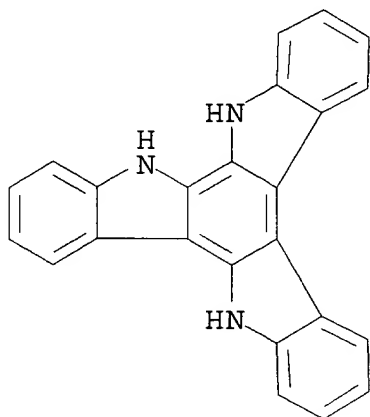


CM 2

CRN 14526-03-5
CMF C2 H2 Cl O2



RN 326492-84-6 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-, radical ion(1+), iodide (9CI) (CA INDEX NAME)



● I⁻

- IT 75833-83-9P
(crystallog.; formation of dications and radical cations by reaction of indole and nitrosobenzene in presence of acids)
- IT 326492-87-9
(formation of dications and radical cations by reaction of indole and nitrosobenzene in presence of acids)
- IT 326492-89-1 326492-90-4 326492-91-5
(formation of dications and radical cations by reaction of indole and nitrosobenzene in presence of acids)
- IT 70381-95-2P
(formation of dications and radical cations by reaction of indole and nitrosobenzene in presence of acids)
- IT 326492-82-4P 326492-84-6P
(formation of dications and radical cations by reaction of indole and nitrosobenzene in presence of acids)

L10 ANSWER 4 OF 10 HCA COPYRIGHT 2003 ACS
129:290079 Acid-Promoted Competing Pathways in the Oxidative Polymerization of 5,6-Dihydroxyindoles and Related Compounds: Straightforward Cyclotrimerization Routes to Diindolocarbazole Derivatives. Manini, Paola; d'Ischia, Marco; Milosa, Mario; Prota, Giuseppe (Department of Organic and Biological Chemistry, University of Naples Federico II, Naples, I-80134, Italy). Journal of Organic Chemistry, 63(20), 7002-7008 (English) 1998. CODEN: JOCEAH. ISSN: 0022-3263. OTHER SOURCES: CASREACT 129:290079. Publisher: American Chemical Society.

GI

* STRUCTURE DIAGRAM TOO LARGE FOR DISPLAY - AVAILABLE VIA OFFLINE PRINT *

AB Oxidn. of 5,6-dihydroxyindole in acidic aq. media led to isomeric hexahydroxydiindolocarbazoles, isolated as the acetyl derivs. I (R = R1 = OAc, R2 = H) (29%) and II (R = R1 = OAc, R2 = H) (19%). When the reaction is stopped in the very early stages, small amts. of the indolyindoline 3-R3-5,6-bis(acetoxy)indole (R3 = 1-acetyl-5,6-bis(acetoxy)dihydro-2-indolyl) and the open trimer 2-(AcNH)-4,5-(AcO)2C6H2CH2CHR42 (R4 = 5,6-bis(acetoxy)-2-indolyl) can be isolated. Similar oxidn. of the N-methyl-5,6-dihydroxyindole and 5,6-methoxyindole, and of 5-methoxyindole, 6-hydroxyindole, and 6-benzyloxyindole, afforded the corresponding diindolocarbazoles I (R = R1 = OAc, R2 = Me; R = R1 = OMe, R2 = H) and II (R = R1 = OAc, R2 = Me; R = R1 = OMe, R2 = H), II (R = R2 = H, R1 = OMe), II (R = OAc, R1 = R2 = H), and the related tetramer I (R = OCH2Ph, R1 = R2 = H) in up to 70% overall yield, whereas 5,6-diacetoxyindole, 5-hydroxyindole, and indole failed to give cyclotrimerization products. Formation of diindolocarbazoles could be explained by a mechanism in which the electron-donating substituents propitiate an array of acid-induced couplings and subsequent dehydrogenation steps driven by the energetically favorable closure of the fused arom. framework.

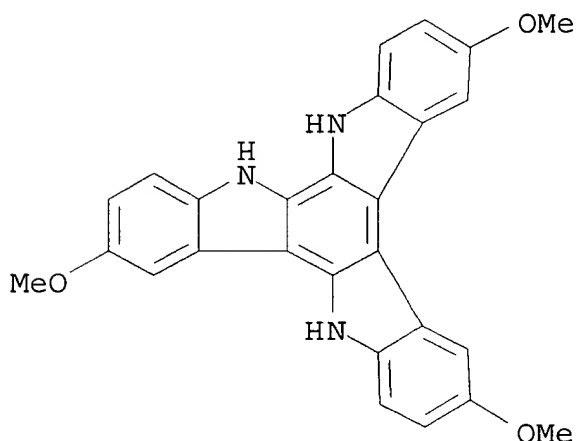
IT 200341-19-1P 214262-49-4P 214262-50-7P

214262-51-8P 214262-57-4P

(prepn. by oxidn. of 5,6-methoxyindoles and related compds.)

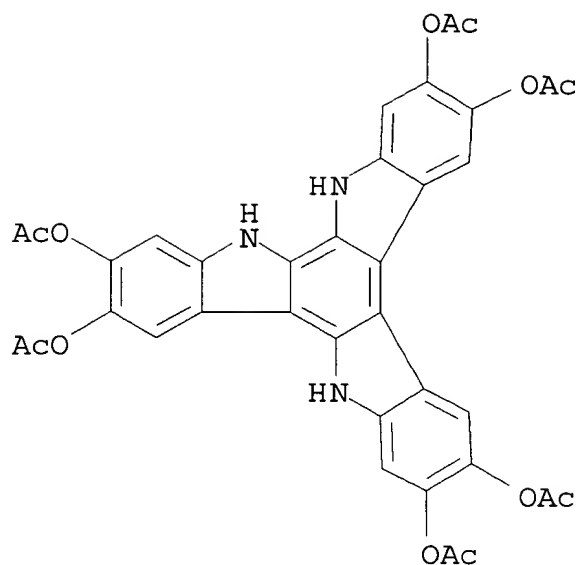
RN 200341-19-1 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-2,9,14-trimethoxy-(9CI) (CA INDEX NAME)

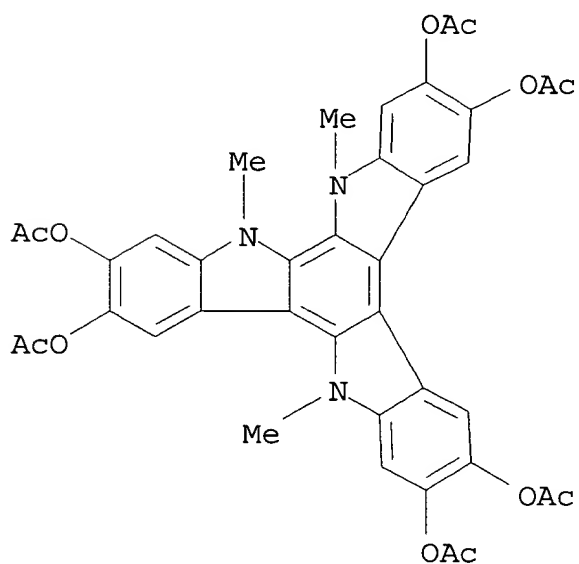


RN 214262-49-4 HCA

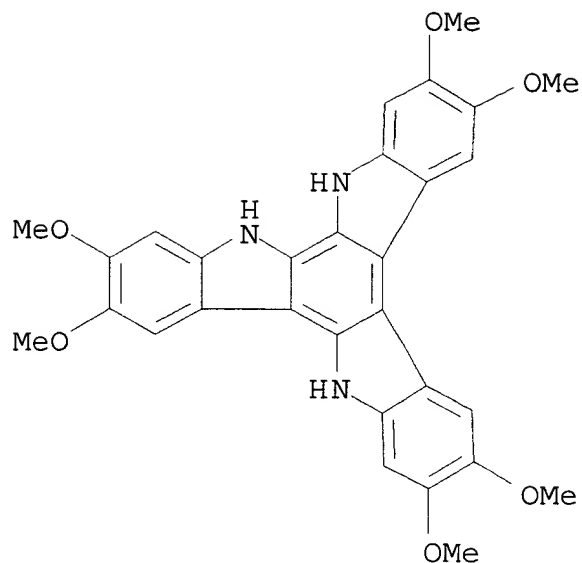
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,3,8,9,13,14-hexol, 6,11-dihydro-, hexaacetate (ester) (9CI) (CA INDEX NAME)



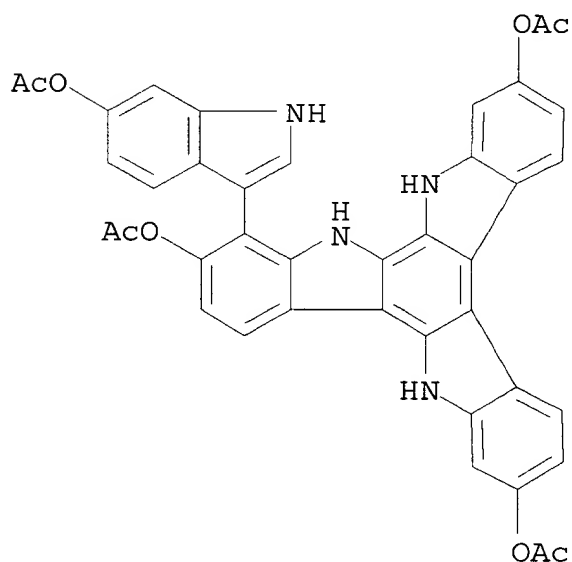
RN 214262-50-7 HCA
 CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,3,8,9,13,14-hexol,
 6,11-dihydro-5,6,11-trimethyl-, hexaacetate (ester) (9CI) (CA INDEX
 NAME)



RN 214262-51-8 HCA
 CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-2,3,8,9,13,14-
 hexamethoxy- (9CI) (CA INDEX NAME)



RN 214262-57-4 HCA
 CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-3,8,13-triol,
 7-[6-(acetyloxy)-1H-indol-3-yl]-6,11-dihydro-, triacetate (ester)
 (9CI) (CA INDEX NAME)



IT 200341-19-1P 214262-49-4P 214262-50-7P
 214262-51-8P 214262-57-4P
 (prepn. by oxidn. of 5,6-methoxyindoles and related compds.)

L10 ANSWER 5 OF 10 HCA COPYRIGHT 2003 ACS
 125:275010 Nitrenium ions. Part 2. Acid-catalyzed reactions of indole

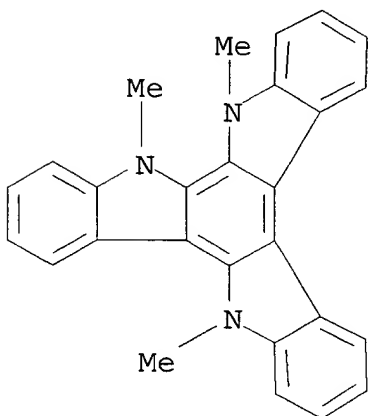
with nitrosobenzenes. Crystal structure of 2-(indol-3-yl)-3-phenylimino-3H-indole. Carloni, Patricia; Greci, Lucedio; Iacussi, Marco; Rossetti, Monica; Stipa, Pierluigi; Rizzoli, Corrado; Sgarabotto, Paolo (Dip. Sci. Mater. Terra, Univ., Ancona, I-60131, Italy). Journal of Chemical Research, Synopses (8), 350-351 (English) 1996. CODEN: JRPSDC. ISSN: 0308-2342. Publisher: Royal Society of Chemistry.

AB The reactions of indole with nitrosobenzenes in the presence of monochloroacetic acid have been studied demonstrating the existence of nitrenium ions; the structure of 2-(indol-3-yl)-3-phenylimino-3H-indole has been detd. by X-ray crystallog.

IT **75833-83-9P 182440-60-4P**
(acid-catalyzed reactions of indole with nitrosobenzenes)

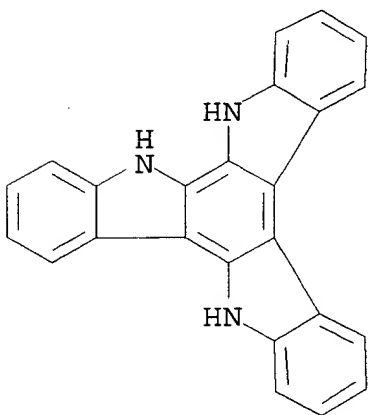
RN 75833-83-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-5,6,11-trimethyl-(9CI) (CA INDEX NAME)



RN 182440-60-4 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-, radical ion(1+)
(9CI) (CA INDEX NAME)

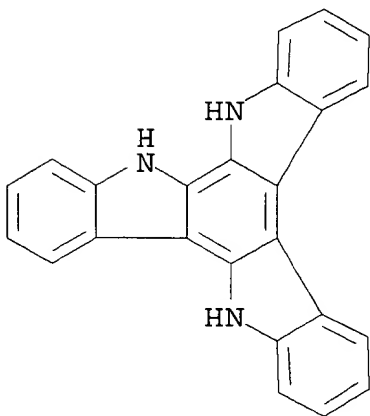


IT **70381-95-2P**

(acid-catalyzed reactions of indole with nitrosobenzenes)

RN 70381-95-2 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro- (9CI) (CA INDEX NAME)



IT 75833-83-9P 182440-60-4P

(acid-catalyzed reactions of indole with nitrosobenzenes)

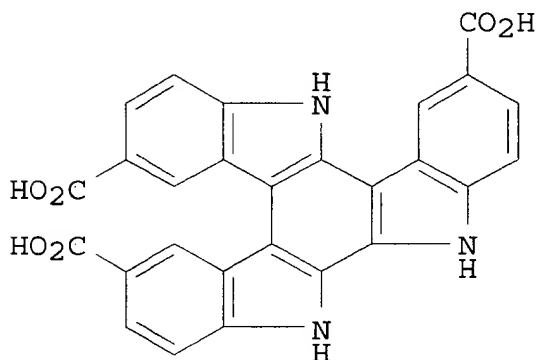
IT 70381-95-2P

(acid-catalyzed reactions of indole with nitrosobenzenes)

L10 ANSWER 6 OF 10 HCA COPYRIGHT 2003 ACS

122:30877 Characterization of the unsymmetrical trimer of indole-5-carboxylic acid by proton NMR spectroscopy. Mackintosh, J. G.; Mount, A. R.; Reed, D. (Dep. Chem., Univ. Edinburgh, Edinburgh, EH9 3JJ, UK). Magnetic Resonance in Chemistry, 32(9), 559-61 (English) 1994. CODEN: MRCHEG. ISSN: 0749-1581. Publisher: Wiley.

GI



I

AB Indole-5-carboxylic acid trimer (I), a major product formed during the electropolymerization of indole-5-carboxylic acid, was characterized by ¹H NMR spectroscopy, and a wide range of one- and two-dimensional

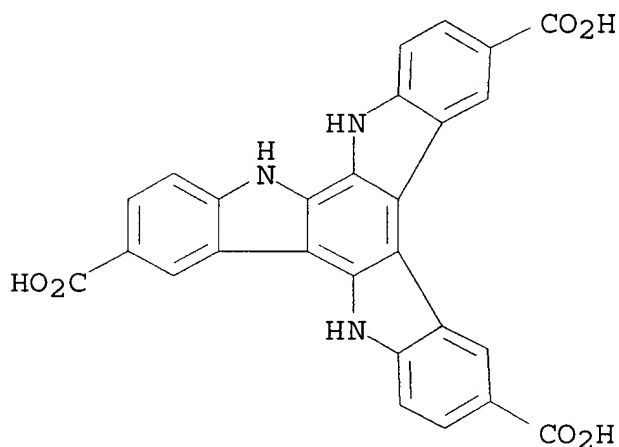
NMR techniques were employed to allow full anal. of the ^1H spectrum, homonuclear NOE expts. were carried out in different solvents and at different temps., owing to the unusual observation of neg. enhancements in some expts. This was shown to be due to the slow tumbling rate of the mol.

IT 158613-71-9

(characterization of unsym. trimer of indole-5-carboxylic acid by proton NMR)

RN 158613-71-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole-2,9,14-tricarboxylic acid, 6,11-dihydro- (9CI) (CA INDEX NAME)



IT 158613-71-9

(characterization of unsym. trimer of indole-5-carboxylic acid by proton NMR)

L10 ANSWER 7 OF 10 HCA COPYRIGHT 2003 ACS

98:16535 Structure elucidation of some compounds obtained by interaction of indigo with hydrazine. Bergman, Jan; Eklund, Nils (Dep. Org. Chem., R. Inst. Technol., Stockholm, S-100 44, Swed.). *Chemica Scripta*, 19(5), 193-204 (English) 1982. CODEN: CSRPB9. ISSN: 0004-2056. OTHER SOURCES: CASREACT 98:16535.

GI

* STRUCTURE DIAGRAM TOO LARGE FOR DISPLAY - AVAILABLE VIA OFFLINE PRINT *

AB The interaction of indigo and hydrazine was studied. In the presence of strong base (OH^-) the anion I is formed, which may be trapped as, e.g., the monoacetate. I is rapidly oxidatively dimerized to II in air. Anhyd. hydrazine converts indigo, depending on the temp., to the competitive rather than consecutive 4-(3H)-quinazolinone derivs. III and IV. The structure III was verified by an independent synthesis as well as by an x-ray study.

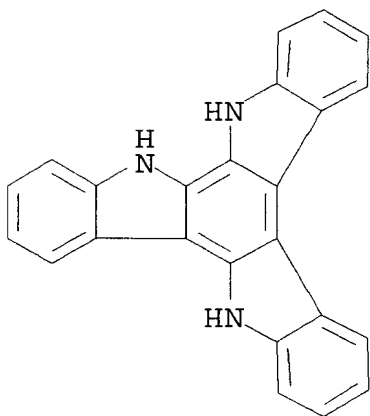
Indoxyl and hydrazine also yielded III and IV. In fact it was found that indoxyl derivs. could be generally ringexpanded with hydrazine to 4-(3H)-quinazolinones. Isoindigo yielded isatin-3-hydrazone and oxindole, whereas indirubin, due to a secondary ring closure gave the pentacyclic compd. V, previously considered to be indirubin hydrazone.

IT 70381-95-2P

(prepn. of)

RN 70381-95-2 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro- (9CI) (CA INDEX NAME)



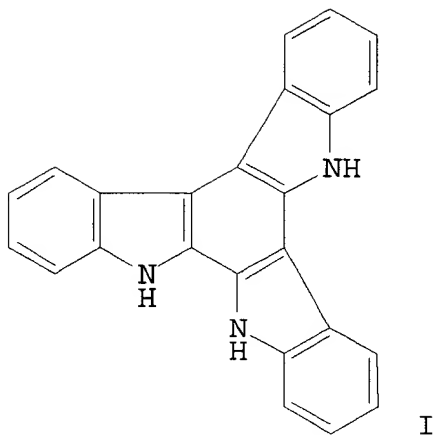
IT 70381-95-2P

(prepn. of)

L10 ANSWER 8 OF 10 HCA COPYRIGHT 2003 ACS

96:122566 Reactions of indole with hydroxyl radicals and x-ray crystal structure of a novel indole trimer, 14-acetyldiindolo[2,3-a:2',3'-c]carbazole. Kaneko, Takao; Matsuo, Mitsuyoshi; Iitaka, Yoichi (Tokyo Metrop. Inst. Gerontol., Tokyo, 173, Japan). Chemical & Pharmaceutical Bulletin, 29(12), 3499-506 (English) 1981. CODEN: CPBTAL. ISSN: 0009-2363.

GI



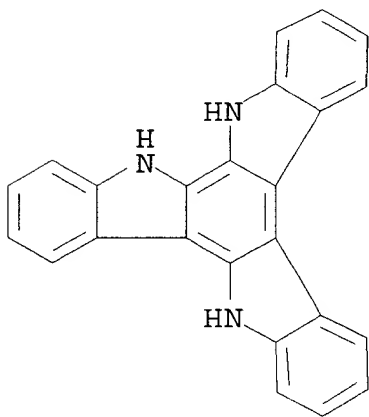
AB When indole reacted with titanium(III)- or iron(II)-H₂O₂ systems, the products varied widely, depending on the pH of the reaction solns. Under acidic conditions, indole gave rise to oxindole, 2,3'-biindole and the diindolocarbazole I. Under neutral conditions, indole was converted to oxindole, hydroxyindoles and 3,3-biindole. The structure of the I was detd. by x-ray diffraction anal. of its monoacetyl deriv.

IT **70381-95-2P**

(formation of, by reaction of indoles with hydroxyl radicals)

RN 70381-95-2 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro- (9CI) (CA INDEX NAME)

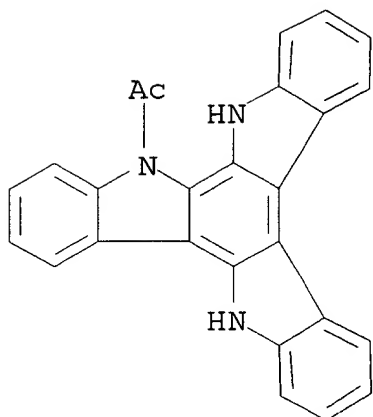


IT **70381-96-3P 70381-97-4P**

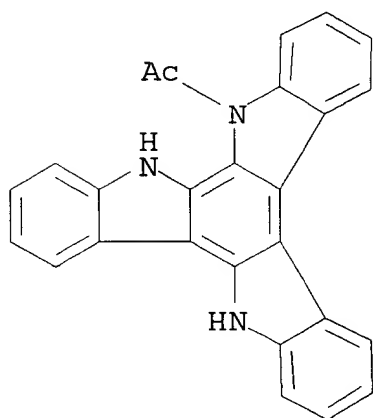
(prep. and crystal structure of)

RN 70381-96-3 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6-acetyl-6,11-dihydro- (9CI) (CA INDEX NAME)



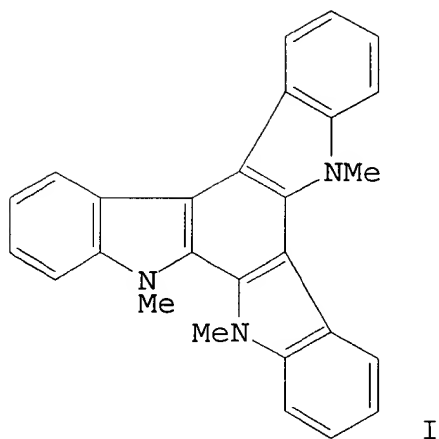
RN 70381-97-4 HCA
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 5-acetyl-6,11-dihydro- (9CI)
(CA INDEX NAME)



IT 70381-95-2P
(formation of, by reaction of indoles with hydroxyl radicals)
IT 70381-96-3P 70381-97-4P
(prepn. and crystal structure of)

L10 ANSWER 9 OF 10 HCA COPYRIGHT 2003 ACS
94:3948 Synthesis and studies of tris-indolobenzenes and related
compounds. Bergman, Jan; Eklund, Nils (Dep. Org. Chem., R. Inst.
Technol., Stockholm, S-100 44, Swed.). Tetrahedron, 36(10), 1445-50
(English) 1980. CODEN: TETRAB. ISSN: 0040-4020.

GI



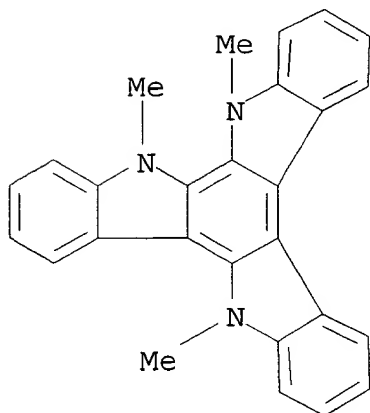
AB The trisindolobenzene I was prepd. by cyclotrimerization of N-methylindoxy O-acetate (CF₃CO₂H, reflux, 2 h) (48%) and from N-methylisatin and N-methylindole in 3 or 4 steps through dehydrocyclization of 2,3-bis(N-methyl-3-indolyl)-N-methylindole. Each prepn. involved a 3.fwdarw.2 Wagner-Meerwein rearrangement. 3,3-Diindolyllindolines were cleaved to 3,3'-biindolyls on treatment with strong acid. E.g., 70% 3,3'-bi(N-methylindolyl) was obtained on treatment of 3,3-bis(N-methyl-3-indolyl)-N-methylindoline with 4:1 EtOH and concd. HCl (10 min).

IT **75833-83-9P**

(prepn. of)

RN 75833-83-9 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro-5,6,11-trimethyl- (9CI) (CA INDEX NAME)

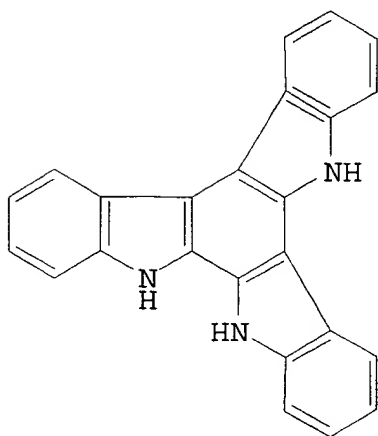


IT **75833-83-9P**

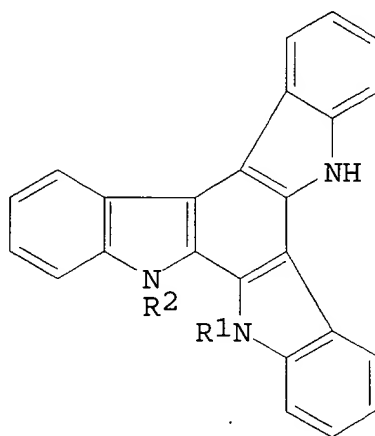
(prepn. of)

91:20238 A novel indole trimer; diindolo[2,3-a:2',3'-c]carbazole.
 Kaneko, Takao; Matsuo, Mitsuyoshi; Iitaka, Yoichi (Tokyo Metrop.
 Inst. Gerontol., Tokyo, 173, Japan). Heterocycles, 12(4), 471-4
 (English) 1979. CODEN: HTCYAM. ISSN: 0385-5414.

GI



I



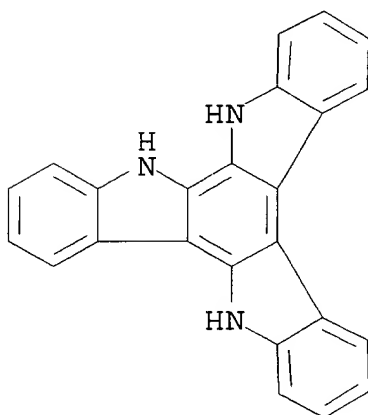
II

AB Reaction of indole with TiCl_3 and H_2O_2 gave the indole trimer, I, which was acetylated to give II ($\text{R}_1 = \text{Ac}$, $\text{R}_2 = \text{H}$; $\text{R}_1 = \text{H}$, $\text{R}_2 = \text{Ac}$) in a 4:1 molar ratio. A radical mechanism explains the formation of I.

IT **70381-95-2P**
 (prepn. and acetylation of)

RN 70381-95-2 HCA

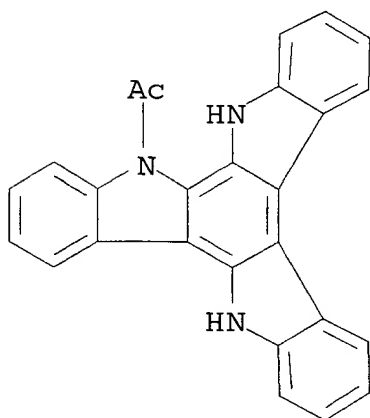
CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6,11-dihydro- (9CI) (CA INDEX NAME)



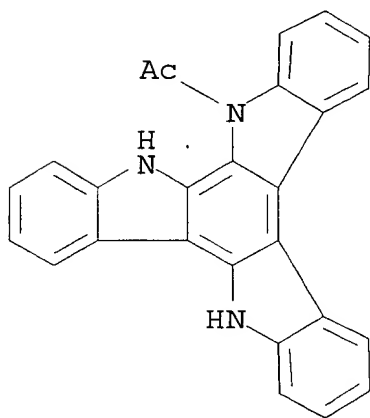
IT **70381-96-3P 70381-97-4P**

(prepn. of)

RN 70381-96-3 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 6-acetyl-6,11-dihydro- (9CI)
(CA INDEX NAME)

RN 70381-97-4 HCA

CN 5H-Diindolo[2,3-a:2',3'-c]carbazole, 5-acetyl-6,11-dihydro- (9CI)
(CA INDEX NAME)

IT 70381-95-2P

(prepn. and acetylation of)

IT 70381-96-3P 70381-97-4P

(prepn. of)